

REMARKS

Applicants have amended their claims in order to further define various aspects of the present invention. Specifically, Applicants have amended claim 1 to recite that the adhesive sheet has a property that it can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing, with the adhesive sheet including a polymer component, which includes acrylic rubber having a glass transition temperature of -30° to 50°C, and a weight-average molecular weight of 50,000 to 1,000,000, the adhesive sheet also including a filler. As to what is meant by stealth dicing, note, for example, the paragraph bridging pages 3 and 4 of Applicants' specification. As for the polymer component, note pages 15-17 of Applicants' specification. As for the inorganic filler, note pages 17 and 18 of Applicants' specification. See also Figs. 1-4 of Applicants' disclosure, together with the description in connection therewith on pages 24 and 25, including use of a laser ray for rendering the wafer to be able to be easily cut by subsequent application of external force. Note also pages 26 and 27 of Applicants' specification, disclosing, inter alia, laser processing conditions.

In addition to amendments to claim 1, Applicants have amended claims 2 and 3 to be dependent claims, dependent on claim 1, and have amended various of the other claims in the application in light of amendments to claim 1. In addition, Applicants have cancelled claims 5, 6, 9, 16-19, 22, 23, 26-29 and 41-43, in order to simplify issues and in light of amendments to claim 1. Thus, in light of present amendments to claims previously in the application, previously considered claims 1-4, 7, 10 and 11 remain in the application.

In addition, Applicants are adding new claims 44-49 to the application. Claim 44, dependent on claim 1, recites that the filler is contained in an amount of 5-70% of the total weight of the adhesive sheet, claim 45 further defining the amount of the filler, these amounts being consistent with the description in the first full paragraph on page 18 of Applicants' specification. Claims 46 and 47, dependent respectively on claims 1 and 46, define amount of acrylic rubber contained in the adhesive sheet, consistent with the description in the paragraph bridging pages 16 and 17 of Applicants' specification. Claim 48, dependent on claim 1, recites that the polymer component further includes epoxy resin, consistent with descriptions, for example, in the first full paragraph on page 17 of Applicants' specification. Claim 49, dependent on claim 1, defines the adhesive sheet, laminated together with the dicing tape onto the wafer, prior to the stealth dicing.

The rejection of claims 42 and 43 under the second paragraph of 35 USC 112, set forth on page 2 of the Office Action mailed March 12, 2007, is moot, in view of canceling of claims 42 and 43.

The nonstatutory obviousness-type double patenting rejections, both actual and provisional, set forth on pages 3-5 of the Office Action mailed March 12, 2007, are noted. For facilitating proceedings in connection with the above-identified application, and to simplify issues, enclosed please find a Terminal Disclaimer for the above-identified application, with respect to U.S. Patent No. 5,965,269, No. 7,070,670 and any U.S. patent issuing from Application No. 11/319,068. It is respectfully submitted that this enclosed Terminal Disclaimer satisfies all requirements of 37 CFR 1.321(c) for the above-identified application, with respect to each of U.S. Patent No. 5,965,269,

No. 7,070,670 and any U.S. patent issuing from Application No. 11/319,068; and that, accordingly, the obviousness-type rejections, both actual and provisional, are moot.

The enclosed Terminal Disclaimer is being submitted so as to simplify remaining issues, and so as to facilitate proceedings in connection with the above-identified application. The present filing of this Terminal Disclaimer does not constitute an admission as to the propriety of, or agreement with, the actual and provisional obviousness-type double patenting rejections; and does not constitute an admission as to the propriety of, or agreement with, arguments made by the Examiner in connection with the obviousness-type double patenting rejections.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the references applied by the Examiner in rejecting claims in the Office Action mailed March 12, 2007, that is, the teachings of the U.S. patent documents to Inada, et al., No. 5,965,269, to Tomiyama, et al., No. 7,070,670, to Yanagiuchi, et al., No. 6,521,337, to Shimada, et al., No. 6,090,468, to Tanaka, et al., No. 6,673,441, and to Teiichi, et al., Patent Application Publication No. 2003/0069331, and the Japanese patent documents No. 09-298369, No. 09-302313, No. 2000-248025, No. 2002-060716, and No. 2002-280494, under the provisions of 35 USC 102 and 35 USC 103.

It is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such an adhesive sheet as in the present claims, having the property that it can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing, with this adhesive sheet, having such recited property, comprising a polymer component which

includes acrylic rubber having a glass transition temperature of -30° to 50° C, and a weight-average molecular weight of 50,000 to 1,000,000, the adhesive sheet also including a filler. See claim 1.

In addition, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such adhesive sheet as in the present claims, laminated together with the dicing tape onto the wafer, prior to stealth dicing. See claim 49.

Furthermore, it is respectfully submitted that the teachings of the applied references would have neither disclosed nor would have suggested such adhesive sheet as in the present claims, having features as discussed previously in connection with claim 1, and, additionally, having the elastic modulus of the adhesive sheet in a B-stage state as in claims 2-4; and/or amount of acrylic rubber contained in the adhesive sheet as in claim 7, and more specifically, as in claims 46 and 47; and/or content of remaining volatile matters in the adhesive sheet, as in claim 10; and/or film thickness of the adhesive sheet, as in claim 11; and/or amount of filler, as in claims 44 and 45; and/or wherein the polymer component further includes epoxy resin (see claim 48).

The present invention is directed to an adhesive sheet, suitable for joining a semiconductor element with a semiconductor-element-mounting support member, and which adhesive sheet can be laminated together with dicing tape onto a wafer and is capable of being subjected to stealth dicing.

In recent years, various wafer-cutting methods have been suggested, for cutting the wafer into individual chips. Such methods include methods of processing the wafer so that, subsequently, the wafer can easily be cut. One technique is the step of forming

modified regions of the wafer by radiating a laser into the wafer along lines intended to be cut; and, subsequently, cutting the wafer, by, for example, the application of external force thereto. This technique is the so-called stealth dicing technique. Note the paragraph bridging pages 3 and 4 of Applicants' specification.

In order to manufacture a semiconductor device according to a wafer-back-face sticking mode by use of, e.g., stealth dicing, it is necessary to cut an adhesive sheet and a wafer simultaneously. However, when conventional adhesive sheets are used, it is difficult to cut the sheet at the same time as a wafer is cut. When a non-elastic adhesive sheet having a good breakability is used as the adhesive sheet, the adhesive sheet and wafer can be simultaneously cut in the state that cutting faces of the two are made substantially consistent; however, the non-elastic adhesive sheet has a low fluidity, and, therefore, the sheet is not easily stuck onto the wafer at relatively low temperatures of, e.g., 100°C or lower. Additionally, the adhesive sheet can be cracked, since the adhesive sheet itself is brittle.

Against this background, Applicants provide an adhesive sheet having the properties of being laminated together with dicing tape onto a wafer prior to stealth dicing, and which is capable of being subjected to stealth dicing discussed previously. Applicants have found that through use of the specific polymer component and filler as in claim 1, the adhesive sheet having properties as in the present claims can be used advantageously in, e.g., stealth dicing. When the adhesive sheet is laminated together with dicing tape onto a wafer and diced by stealth dicing, the adhesive sheet shows excellent breakability and laminating properties, as shown in Tables 1 and 4 on pages 34 and 46, respectively, of Applicants' specification.

The rejection of claims under 35 USC 102 and/or under 35 USC 103, over Yanagiuchi, et al., set forth on pages 7 and 8 of the Office Action mailed March 12, 2007, is noted. It is to be noted that claim 6 has not been rejected over the teachings of Yanagiuchi, et al. In light of incorporation of subject matter of claim 6 into claim 1, it is respectfully submitted that the prior art rejections over the teachings of Yanagiuchi, et al. are moot.

In any event, it is respectfully submitted that Yanagiuchi, et al. would have neither taught nor would have suggested such an adhesive sheet as in the present claims, having the property that the adhesive sheet can be laminated together with dicing tape onto a wafer prior to stealth dicing, and is capable of being subjected to stealth dicing, and wherein the adhesive sheet includes, inter alia, a polymer component which comprises acrylic rubber having the glass transition temperature and weight-average molecular weight of claim 1, together with a filler.

Similarly, it is noted that the Examiner has not rejected claim 6 over the teachings of Japanese Patent Document No. 2002-280494, on page 9 of the Office Action mailed March 12, 2007. In view of amendments to claim 1, it is respectfully submitted that the rejection over No. 2002-280494 is moot.

The rejections of claims under 35 USC 102 or under 35 USC 103 as set forth on pages 8 and 9 of the Office Action mailed March 12, 2007, are noted. Ten references individually are applied in these rejections on pages 8 and 9. As will be shown in the following, it is respectfully submitted that these references would have neither taught nor would have suggested such adhesive sheet as in the present claims, and advantages thereof.

Inada, et al. discloses an adhesive produced by preparing a varnish of a composition, the composition being described, for example, in column 4, lines 12-34 thereof. The composition can include an inorganic filler, as disclosed in column 8, lines 8-37, for example.

Tomiyama, et al. discloses an adhesive composition as described most generally in column 5, lines 19-48, and an adhesive film as described most generally in column 5, line 49 to column 6, line 15. The adhesive film is described as being a film that connects a semiconductor chip and a substrate, or connects semiconductor chips themselves, as described in column 5, lines 49-53. Note also column 24 of Tomiyama, et al., disclosing addition of inorganic fillers to the adhesive composition.

It is respectfully submitted that neither of Inada, et al. or Tomiyama, et al. discloses adhesive sheets used for stealth dicing; or, more particularly, having properties as in the present claims, such that the adhesives can be used for stealth dicing. It is respectfully submitted that these references do not consider about breakability and laminating properties, achieved according to the present invention.

Shimada, et al. discloses an adhesive composition for multilayer wiring boards for mounting a semiconductor device, the adhesive composition being described, for example, in column 2, lines 28-62 thereof. Note also column 7 of this patent, disclosing including inorganic fillers in the adhesive composition.

As with Inada, et al. and Tomiyama, et al., it is respectfully submitted that Shimada, et al. does not consider breakability and laminating properties of the adhesive sheets; and it is respectfully submitted that this reference does not disclose, nor would

have suggested, the combination of specific polymer component and filler, or properties, providing an advantage in application for stealth dicing.

Tanaka, et al. discloses an adhesive, in columns 3 and 4 of the patent, including an epoxy resin and a hardener therefor, together with a latent curing accelerator and an epoxidized acrylic copolymer. The glass transition temperature and weight average molecular weight of the epoxidized acrylic copolymer are disclosed.

Teiichi, et al. discloses an adhesive composition for use in mounting semiconductors, the adhesive composition being described on page 2 of this patent document, e.g., in paragraph [0017] thereof.

It is respectfully submitted that neither of Tanaka, et al. or Teiichi, et al. would have disclosed or would have suggested the adhesive sheet of the present claims, having the specific components of the specified acrylic rubber and the filler, and the properties such that the sheet has advantages in stealth dicing, including breakability and laminating properties.

Attention is also directed to the four Japanese patent documents applied by the Examiner on page 8 of the Office Action mailed March 12, 2007.

No. 9-298369 discloses an adhesive layer for a multilayer wiring board, having a specific modulus of elasticity and including an epoxy resin and a phenolic resin together, together with a high-molecular-weight resin which is compatible with the epoxy resin, a rubber whose weight average molecular weight is 100,000 or higher, and a hardening promoter, as well as an organic filler.

No. 9-302313 discloses an adhesive or bonding sheet including liquid epoxy resin and its curing agent, a high-molecular-weight resin, curing accelerator, coupling agent and inorganic filler, for use in preparing a multilayered wiring board.

No. 2000-248025 discloses acrylic resins suitably used for adhesives and adhesive films having various properties required when installing semiconductor chips having large differences in heat expansion coefficients to various high density printed circuit boards.

No. 2002-060716 discloses a low-elastic adhesive having heat and moisture resistances required for packaging a semiconductor chip having a great difference in coefficient of thermal expansion in a wiring substrate, this adhesive including an epoxy resin and curing agent therefor, an epoxy group-containing acrylic copolymer having specified glass transition temperature and number-average molecular weight, a curing accelerator, silicone rubber filler and a coupling agent.

It is respectfully submitted that none of the applied Japanese patent documents disclose or would have suggested properties for stealth dicing as in the present claims, and, in particular, do not disclose, nor would have suggested, an adhesive sheet as in the present claims, having the specific polymer component and filler, and having advantageous breakability and laminating properties for stealth dicing, as in the present claims.

The contention by the Examiner as to inherency of properties, set forth in Item 11 on page 8 of the Office Action mailed March 12, 2007, is noted. It is emphasized that the compositions of references in the prior art include many different materials, having effects on properties of the composition. In view of the specifically disclosed

compositions of the prior art, including components in addition to those in the present claims, it is respectfully submitted that the Examiner has not established inherency.

In view of all of the foregoing comments and amendments, reconsideration and allowance of all claims presently pending in the above-identified application is respectfully requested.

Applicants request any shortage in fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 1204.45675X00), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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Enclosure: Terminal Disclaimer

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